3GPP TSG-RAN WG3 #119bis-e R3-231892

17th – 26th April 2023

Online

Agenda Item: 17.2

Source: Samsung (moderator)

**Title: Summary of Discussion on CB: # NTN1\_ServiceContinuity**

Document for: Discussion & Decision

# Introduction

This document is used for discussion and decision for the CB as follows,

**CB: # NTN1\_ServiceContinuity**

**- Cell ID exchanged via Xn Setup and Configuration Update messages?**

**- Multiple TACs over Xn?**

**- Details of time-based HO info over NG, e.g., time-related info, data forwarding enhancement?**

**- Any other issues?**

**- Capture agreements and provide TPs if agreeable**

(moderator - SS)

Summary of offline disc

This CB is planned to be carried out in two rounds:

Round 1: Till EOM of Friday, the first week. Collect comments for open issues.

Round 2: Whether to have Round 2 depends on the progress of online session.

# For the Chairman’s Notes

**Agreements:**

**Proposal 1: WA: Uu Cell ID is used to be exchanged via Xn Setup and Configuration Update procedure.**

**Proposal 2: WA: Do not exchange TAC(s) over Xn for NTN.**

**Proposal 3: Confirm to add the handover window start and duration IEs to the NGAP Source NG-RAN Node to Target NG-RAN Node Transparent Container IE. Endorse R3-231418 as the BL CR.**

**Proposal 4: Confirm to enhance the early data forwarding with data discarding for NG HO.**

**Proposal 5: Introduce a DL discarding related IE in Early Status Transfer Transparent Container IE. FFS on the IE name and other details.**

**Proposal 6: WA: The propagation delay problem should be considered for time-based HO, which can be solved by gNB implementation.**

**Proposal 7: No more discussion on the exchanging of serving cell coverage stop time over Xn, unless clear advantage(s) of Xn signaling over OAM configuration is newly identified.**

**Capture the following in the minutes:**

**RAN3 understands it is unlikely that a source gNB prepares more than one potential target cells for NG HO.**

**Liaise SA2 when there’s no open issues left for time-based NG HO.**

**Open issue to the 2nd round or next meeting:**

**FFS on TPs to stg2 and stg3 to reflect RAN3 progress.**

# Discussion (Round 1)

## Cell ID and TAC(s)

The Cell ID exchanged by Xn Setup and Configuration Update has been discussed for several meetings.

Regarding this issue,

Samsung [1] proposes: **Proposal 1: It is suggested to use Uu cell ID associated with multiple TACs to be exchanged via Xn setup and Configuration Update procedures.**

Qualcomm, CATT, Nokia and NEC [2] proposes: **Proposal 1: Uu Cell ID is used in Xn procedures as per legacy behavior for NTN. Endorse the TP to TS 38.300**

China Telecom [11] proposes: **Proposal 1: Uu cell ID should be used over Xn Setup/Configuration Update procedure, if the Served Cell Information NR is exchanged between two NTN-gNBs.**

CATT [12] proposes:

**Proposal 1: Uu Cell ID should be used in Xn Setup and Configuration Update procedures. Proposal 3: The Xn procedures could follow legacy behaviours by using Uu Cell ID and no issue is identified to Uu Cell ID in Xn procedures.**

ZTE [13] proposes: **Proposal 1: Exchange the mapped cell ID with single TAC over Xn for non-UE associated Xn procedures.**

Huawei [15] proposes: **Proposal 1: There is no need to specify the cell ID usage for all the cases including the non-UE associated message like Xn setup request.**

In summary, there are three options on the table:

**Option 1**: Uu Cell ID

**Option 2**: Mapped Cell ID

**Option 3**: No need to specify the Cell ID usage

Compared to the last meeting,

The proponents of Option 1 additionally provide the following explanations [2],

**Observation 1: Since PCI is associated to Uu Cell ID, the mapped cell ID will have time varying PCI in EMC case. If mapped cell ID is used for Xn setup and config update messages, then PCI needs to be updated which increases the Xn signaling.**

**Observation 2: When Mapped Cell ID falls in the overlapping area of two or more Uu Cell IDs, then one Mapped Cell ID will have multiple PCIs.**

**Observation 5: TN neighbors sending Uu Cell ID over Xn and NTN neighbors sending Mapped Cell ID over Xn will cause confusion at the receiving node.**

The proponent of Option 3 additionally provide the following explanation [15],

*We are wondering is there really a need to specify clearly the cell ID usage for all the cases. The NR CGI is at least also used in cell activation and node configuration update in Xn; F1 setup request, GNB-DU/GNB-CU configuration update, Resource Status Report/Update, UE context setup, Access success, initial UL RRC Message and Paging in F1; and E1 setup request in E1. In our understanding, with the OAM effort, which is anyway needed, each node should know the mapping relationship of mapped cell ID and Uu cell ID at a certain time. Then we do not see the need to specify cell ID usage for all the cases, and RAN3 has never discussed the other cases.*

1. There are many other appearance of cell IDs in various interfaces, whose cell ID usage has never been discussed.

So we’d like to ask,

**Q1: Regarding the Cell ID exchanged via Xn Setup and Configuration Update procedure, which option would you prefer?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Ericsson | 3 | We agree with the analysis in [15] (but we also have some sympathy with the analysis in [12]: in general, NTN RAN is never going to be “plug and play”. In principle, all options could work, and they will all need varying levels of OAM intervention. For this reason, by the way, the 3 observations in favor of Opt. 1 mentioned above do not seem entirely correct. |
| CATT | 1 | Now, we do not see any clear benefits to exchange mapped Cell ID(s) in Xn Setup and Configuration Update procedures. Therefore, we should not extend the using of mapped Cell ID without clear motivation. |
| China Telecom | 1 | The Uu Cell ID is sufficient, and the case of using mapped Cell IDs is unclear. |
| Nokia | 1 | Option 3 cause confusion to the receiver NTN gNB, e.g. in case one neighbor send the Xn Setup with Uu cell ID, and another neighbor send the Xn Setup with Mapped cell ID. RAN3 only agreed that Mapped Cell ID is provided in NGAP in 16.14.5, but spec text on using Mapped Cell ID in other cases, e.g. Xn. |
| Qualcomm | 1 | As explained in our paper, based on Observation 1, 2 and 5, we clearly see no benefits of using Mapped Cell ID. Hence we think Uu Cell ID is the better option.  For E///’s comment, we think we should follow legacy behaviour of using Uu cell ID in all Xn procedures. Only when there is a exeception to use Mapped Cell ID, it should be captured in RAN3 specification.  Leaving the cell ID usage causes IoT issues which we want to avoid. |
| Samsung | 1 | We need to be clear on which cell ID is used for Xn Setup and Configuration update procedure to avoid inter-operability issue. |
| NEC | 1 | The Uu Cell can identify a specific cell, so Uu Cell ID was agreed upon for the handover procedure in the last meeting. Considering the Serving Cell Information NR and Neighbor Information NR, the cell ID needs to be defined without confusion for the Xn procedure. |
| ZTE | See comments | Actually, our intention is combine the cell ID and TAC together for the Xn procedures. And if the mapped cell ID is applied, there is no need to introduce multiple TACs over Xn which has less impact on specification. However, if the majorities support the Uu cell ID, we are fine with it. |
| Huawei | 2 or 3 | The observation 1 and 2 above are wrong!!!! These observations totally ignore that the “Cell Id” is logical concept different from a Physical Cell. Like in TN a Physical area representing a cell can handle multiple logical Cell identities …  We can accept option 3, and coexistence of Mapped Cell ID and Uu Cell Id, there is no need to specify which cell ID it use. Anyway OAM effort is inevitable. We noticed also that the cell ID is used in many different cases, which we have never discussed! We also have concern on binding this discussion now with “Legacy SON” function which was never discuss in context of NTN event not part of this work item….  We then have a serious concern on forcing the usage of Uu Cell ID, option 3 is a consensus today, could be revised or corrected in future SON NTN discussion or in case of IOT. |
| Thales | 1 | A cell ID usage should be clarified for Xn procedure and we do not see scenario where mapped cell ID is necessary. |
| Intelsat | 1 | Cell ID should be exchanged over Xn |
| Deutsche Telekom | 1 or 3 | We have some preference on the use of Uu cell ID instead of Mapped cell ID, but we acknowledge Huawei’s statement that there is a need for further discussion on some usage scenarios. |
| Lockheed Martin | 1 | for Xn, the Uu Cell ID should be preferred over Mapped Cell ID |

Moderator’s summary:

13 companies provide comments.

10/13 companies prefer Option1. 2/13 companies prefer Option2. 3/13 companies prefer Option3. (The preference is counted multiple times for companies prefer multiple options)

As a summary, there’s a clear majority of supporting Option1, and the moderator also notice the companies supporting option3 argue that OAM is inevitable. In order to reflect the majority view, the moderator would suggest to make a working assumption as a way forward,

**Proposal 1: WA: Uu Cell ID is used to be exchanged via Xn Setup and Configuration Update procedure.**

Another open issue which has also been extensively discussed is whether we exchange single TAC or multiple TACs over Xn.

Regarding this issue,

Samsung [1] proposes: **Proposal 1: It is suggested to use Uu cell ID associated with multiple TACs to be exchanged via Xn setup and Configuration Update procedures.**

Qualcomm [3] proposes:

**Proposal 4: Similar to TAI support list for slices, extended TAC list can be exchanged over XN Setup and Config Update messages.**

**Proposal 5: Endorse TP for TS 38.423 for addition of extended TAC to Served Cell Information**

China Telecom [11] proposes: **Proposal 2: It is beneficial to exchange multiple TACs via Xn setup and Configuration update messages, RAN3 needs to further discuss the impact on EMC case.**

CATT [12] proposes:

**Proposal 2: It’s un-necessary to exchange multiple TACs per PLMN for NTN cells in XN Setup procedure and Configuration Update procedure.**

ZTE [13] proposes: **Proposal 1: Exchange the mapped cell ID with single TAC over Xn for non-UE associated Xn procedures.**

Huawei [15] proposes: **Proposal 2: In the scenario of NTN, we do not exchange the TAC(s) and leave it to OAM**

In summary, there are three options on the table,

**Option 1**: Multiple TACs

**Option 2**: Single TAC

**Option 3**: Do not exchange TAC(s) over Xn for NTN

According to the contributions, whether to use single or multiple TACs is also associated with which Cell ID to be exchanged over Xn. And the proponents of Option 3 provides the additional explanations as follows,

CATT [12]:

*In the Xn Setup procedure, the List of Served Cells NR to be exchanged between the gNBs is optional,*

*…From implementation point of view, it’s possible to exchange the served cells and neighbour relations in case of earth fixed cells are deployed, like the way in TN. It may not need to exchange the served cells and neighbour relations in case of earth moving cells are deployed. The served cell information and its neighbour relations could be left to OAM.*

Huawei [15]:

**Observation 3: OAM effort and NRT is anyway needed to help nodes understand the neighbour relationship of peer nodes.**

So we’d like to ask,

**Q2: Regarding whether to exchange multiple TACs over Xn, which option would you prefer?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Ericsson | 3 | We agree with the analysis in [12] and [15]. The use of NRT/ANR in NTN RAN will not be the same as in terrestrial networks. |
| CATT | 3 | No need to exchange TAC(s) over Xn for NTN, both quasi earth fixed cell case and earth moving cell case could follow legacy behavior which is analyzed in [12]. We agree with the Observation 3 in [15], and if need, it could be configured by OAM, |
| China Telecom | 1 or 3 | We think multiple TACs may be broadcast in a NTN cell, and option 2 should be ruled out. If there is no consensus on the issue of frequent signaling updates in earth moving cell case, it could be configured by OAM. |
| Nokia | 1 or 2 | Even in case OAM is use, the serving cell still have problem to use the TACs to determine whether target NTN cell belong to a forbidden area. For example, in case of TN – NTN mobility, how does the TN make the decision?  In case Option 1 is adopted, it may cause frequent Xn signaling to update the TAC info as the satellite moves, but this may be addressed by the timing information associated with a TAC, e.g. a specific TAC is valid during a period.  Option 2 has the benefit that it can avoid the frequent Xn signaling used in Option 1, since the Mapped Cell ID + TAC is static. |
| Qualcomm | 1 | TAC of the neighboring nodes is necessary for MRL. For TN cells the TAC is received via Xn for neighboring nodes, why do we need to have a different behavior for NTN cells?  We cannot leave everything to OAM (legacy way of working) when we have a well defined Xn interface to enable plug and play.  Moreover as detailed in our paper, exchanging multiple TACs is not new. It is already done over Xn for Slice feature.  When it comes to signaling overhead, it can be avoided by exchanging the TACs supported by the neighboring cell in one shot during setup. |
| Samsung | 1 or 3 | If companies prefer an XnAP approach, then signaling multiple TACs is straightforward and easier to solve the forbidden area concern: as long as one of the TACs for the target cell is not in the forbidden area then the source node can initiate handover procedure to the target cell.  From another perspective, OAM solution is always ready to be used, if companies prefer not to perform frequent configuration update over Xn. |
| NEC | 3 | Option 2 seems not applicable when Uu cell ID is used in Xn procedures for EMC since the satellite is moving over the ground while TACs correspond to a fixed area on the ground; the Uu cell ID will cover two or more TAC areas simultaneously. In this case, which TAC needs to be transmitted?  Both Option 1 and Option 3 have their pros and cons.  Option 1 seems a comprehensive solution because it considers the Mobility Restriction List IE for roaming and access restriction apply to the UE. Still, the cost is the significant overhead of the Xn update.  For Option 3, if the TAC(s) is not transmitted over Xn for NTN, it avoids the frequent update for the Xn update procedure, but the UE shall consider that there is no roaming and no access restriction, which may lead to a handover problem. However, good cell planning by NTN network operators can minimize this side effect. Also, the trace and neighbors of the satellite are known in gNB, so gNB has the space to minimize the influence of this problem.  Overall, we prefer Option 3. |
| ZTE | 1 or 3 | If the Uu cell ID is applied, in principle, the multiple TACs shall be introduced over Xn. In this case, Option 1 should be selected.  However, the OAM solution is always feasible, and Option 3 is also acceptable from our side. |
| Huawei | 3 | Agree with Ericsson and CATT. Again, option 1 coincides with the legacy method, which may cause bad impacts. OAM is anyway there, let’s rely on OAM, and there is no need for enhancement to TAC. |
| Thales | 1 or 3 | Multiple TACs exchange over Xn associated with Uu cell ID is the most straightforward option, but we could also rely on OAM for TACs. |
| Intelsat | 1 or 3 | The TAC information and its exchange is very much dependent on the design of the network, but both options would work well. |
| Deutsche Telekom | 3 | We share CATT’s and NEC’s view. |
| Lockheed Martin | 3 | For NTN, the OAM can address this need |

Moderator’s summary:

13 companies provide comments.

7/13 companies prefer Option1. 1/13 companies prefer Option2. 11/13 companies prefer Option3. (The preference is counted multiple times for companies prefer multiple options)

As a summary, compared to other options, Option3 is supported or at least accepted by most of the companies with the reason that the OAM solution is anyway there which we could rely on. So the moderator would suggest to make a working assumption on Option3 as follows,

**Proposal 2: WA: Do not exchange TAC(s) over Xn for NTN.**

**Brief summary: The moderator makes the following proposals in 3.1.**

**Proposal 1: WA: Uu Cell ID is used to be exchanged via Xn Setup and Configuration Update procedure.**

**Proposal 2: WA: Do not exchange TAC(s) over Xn for NTN.**

## Time-based NG HO

The first question is whether we add Handover Window Start and Handover Window Duration in the Source to Target Transparent Container over NGAP. According to the contributions, it seems that no company opposes such approach. So the moderator would propose to confirm this approach, which is also proposed by the contribution [7] (co-sourced by a bunch of companies) and [13].

**Proposal X: Confirm to add the handover window start and duration IEs to the NGAP *Source NG-RAN Node to Target NG-RAN Node Transparent Container* IE.**

**Q3: Can we confirm the Proposal X above?** Please provide your comment, if any, in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Ericsson | Yes |  |
| CATT | Yes | There is no doubt about it. |
| China Telecom | Yes |  |
| Nokia | Yes |  |
| Qualcomm | See Comments | We have no issues with adding the IEs to the Transparent container. But we would like to first agree on the stage 2 aspects before going into the stage 3 IE details like –   * Applicability of Early Data forwarding * Whether HO Request will be sent to multiple targets * Whether source will add the CHO condition to the RRC Reconfig for the UE |
| Samsung | Yes | The window related time-based NG HO has been extensively discussed for several meetings, and it seems companies have achieved consensus on such issue. So regarding this issue itself, we are able to look into stg3 details, and other open issues can be discussed separately. |
| NEC | Yes |  |
| ZTE | Yes |  |
| Huawei | Yes |  |
| Thales | Yes |  |
| Intelsat | Yes |  |
| Deutsche Telekom | Yes |  |
| Lockheed Martin | Yes |  |

Moderator’s summary:

12/13 companies confirm such proposal. And one company is fine with the proposal and suggests to have more discussions on other open issues regarding time-based NG HO. So the moderator suggests to agree the following proposal,

**Proposal 3: Confirm to add the handover window start and duration IEs to the NGAP *Source NG-RAN Node to Target NG-RAN Node Transparent Container* IE. Endorse R3-231418 as the BL CR.**

The next open issue is whether to enhance data forwarding for NG HO. Multiple companies show great interest in enhancing the early data forwarding especially allowing the source node to indicate which data forwarded and stored at the target node can be discarded. For example, as observed by NEC [4],

**Observation 2: the problems of time-based trigger NG-HO are:**

1. **The Target gNB buffers a large amount of the data from Source gNB, which is challenging for Target gNB.**
2. **A long-time date forwarding takes many NGAP resources, and most of the data is useless;**
3. **UE will receive many data from Target gNB, which Source gNB already transmits; the handover interruption is equivalent to being extended.**

As a result, the proponents provides the following proposals,

NEC [4] proposes:

**Proposal 1: the options listed below are advised to discuss in RAN3:**

**Option 1: Do nothing and wait for NG-CHO to be supported in TN.**

**Option 2: *Early Status Transfer Transparent Container* IE is suggested to support CHO.**

**Option 3: Introducing a new IE to inform Target gNB to discard the buffered data when UE detaches from the Source gNB.**

**Proposal 2: We prefer Option 2 because it can solve the problems in Observation 2.**

Nokia [9] proposes: **Proposal 1-1: introduce a new *DL Discarding* IE needed to be introduced in NGAP, e.g. UPLINK RAN EARLY STATUS TRANSFER message and DOWNLINK RAN EARLY STATUS TRANSFER message.**

CATT [12] proposes: **Proposal 4:**  **To support time based CHO in Uu, there may be some benefits to enhance data forwarding for NG handover, and its proposed RAN3 to further discuss this issue in the future meetings.**

Since no company clearly opposes such enhance, so we’d like to ask,

**Q4: Can we confirm to enhance the early data forwarding with data discarding for NG HO?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Ericsson | Yes but | Signaling time window parameters simplifies data forwarding handling at HO, because the involved gNBs know exactly when to start data forwarding (i.e. at the start of the time window or right before it) and how much data buffering will be needed (i.e. this is proportional to the time window duration). But we acknowledge that especially for very long time windows this may create problems to some implementations.  So, we do have some sympathy for the analyses in [9] and [4]. Notice that this is only between the source and target gNBs, so we would be OK with adding information to the source-to-target transparent container to avoid unnecessary impact to the AMF. |
| CATT | Yes, pending to the Handover window. | Whether need to do the enhancement on the data forwarding is up to the duration time of the handover window.  Typically, the source gNB should not set a long handover window.  In case of the short handover window, the enhancement on data forwarding is not so essential.  But in case the handover window duration time is very long, it seems beneficial to consider the issue of data forwarding. |
| China Telecom | Yes, pending to the Handover window. | Agree with CATT. |
| Nokia | Yes | Introduce a DL Discarding IE in Early Status Transfer Transparent Container IE.  For comments to use “short” time window, how long is the “short” time window? Even the duration is short to 1 second, it still cause problem. It is not just the target gNB need to unnecessarily buffer the 1-second DL data, but it add the unacceptable 1-second delay to the new DL data since target gNB first send the buffered 1-second data then the new data.  Also, this “short time window” requires a new behavior in source gNB that does not exist in current Xn-CHO with time-based trigger condition. A source gNB can set any duration value according to the duration defined in RAN2.  So a solution is needed to support a normal gNB who can set any duration value according to the duration defined in RAN2. |
| Qualcomm | Yes | In case of legacy NG HO, data forwarding starts immediately after RRC Reconfig is sent to UE. But in time based NG HO case, source need not perform immediate data forwarding after RRC Reconfig is sent to UE.  3 options for data forwarding -   * Source can start data forwarding at T1 until HO success is received. In case of longer HO duration T2 this will cause unnecessary data forwarding. * Source can do data forwarding after HO success is received from the target. This would increase the HO latency for data forwarding. * Source can do early forwarding like CHO with data discard indication.   We think out of the above 3 options, early data forwarding proposed in Nokia paper [9] makes more sense. |
| Samsung | Yes | Considering the large coverage area for an NTN Uu cell and the overlapping area could also be large for two NTN Uu cells, we cannot just assume a ‘short’ time window for all cases. So such mechanism could be useful.  And we assume such discarding indication should be included in Early Status Transfer Transparent Container which will not impose extra requirement to AMF. |
| NEC | Yes | As mentioned in [4], it will have some obvious problems if no enhancement is performed, which are a) Target gNB buffers a large amount of the data from Source gNB, which is challenging for Target gNB; b) A long-time date forwarding takes many NGAP resources, and most of the data is useless; c) UE will receive many data from Target gNB, which Source gNB already transmits; the handover interruption is equivalent to being extended. |
| ZTE | Yes | As mentioned above, we cannot only simply assume the short handover window, the case of long handover window should also be considered, and the details of enhancement on early data forwarding could be further discussed. |
| Huawei | Yes | We acknowledge the problem and ok with an enhancement on top of Time based information. |
| Intelsat | Yes |  |
| Deutsche Telekom | Yes | We see the benefits with the proposed enhancements. |
| Lockheed Martin | Yes | Agree with the benefits already mentioned. |

Moderator’s summary:

All companies confirm to enhance the early data forwarding with data discarding for NG HO.

And the moderator notice that the proposed stg3 solution on the table seems to be convergent, so the moderator would like to additionally check if some stg3 detail can also be easily agreeable to make further progress.

**Proposal 4: Confirm to enhance the early data forwarding with data discarding for NG HO.**

**Proposal 5: Introduce a DL discarding related IE in Early Status Transfer Transparent Container IE. FFS on the IE name and other details.**

The next open issue is whether the source node will send HO Request to multiple target cells for the same UE (just like the behavior for Xn CHO), which is also pointed out by [3].

Regarding this issue, Huawei [16] proposes:

**Proposal 2: RAN3 should discuss if any enhancement is needed for the time-based Handover.**

**Proposal 3: RAN3 to also consider use the time-related IEs for pre-configuration.**

So we’d like to check companies’ view on this open issue.

**Q5: Whether the source node can send multiple HO REQUEST messages to multiple target cells for the same UE during NG HO for NTN?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Ericsson | Probably not | In general, inter-gNB mobility in NTN is much more predictable than in terrestrial networks due to the periodic satellite movement and NTN GW positions. So it’s extremely unlikely that a source gNB would prepare a HO to more than 1 (maybe 2) potential target gNBs. |
| CATT | Probably not | Normally, there’re quite few NTN-GWs deployed on the surface of the earth, we can try to imagine the NG based handover in NTN may only happen in the areas between the coverage of the two NTN-GWs. And normally time based CHO in the Uu is used for earth fixed cell deployment, or the feeder link switch.  Similar view as Ericsson, the target cell is predictable, not likely to configure more than one target gNBs. |
| China Telecom | Probably not | Considering the periodicity and predictability of satellite constellation, as well as the limitation of actual deployment of NTN gateway, the source gNB is unlikely to configure multiple target gNBs for the UE. |
| Nokia | Probably not | Agree with Ericsson that it is most likely only 1 target cell to be prepared. It is complex to allow parallel HO preparation to multiple target cells of same target gNB. |
| Qualcomm | See Comments | We cannot predict what the actual deployments are currently and will be in future.  If there is a possibility to provision sending HO Request to more than 1 target over NG, we would support that to provide flexibility in the standards. |
| Samsung | Probably not but | We prefer to start with simple assumptions, but more clarification from NTN operator may be needed on whether there’s case that multiple NTN cells can provide the similar coverage in an area. |
| NEC | Probably not | Agree with Ericsson. |
| ZTE | Probably not | Share the view with Ericsson. |
| Huawei | See comment | Our initial thinking is there can be multiple targets (even not so many). If it is a common understanding of the group that most likely only 1 target cell will be prepared, then we are fine with no enhancement… However, we need capture such assumption as a minute or agreement. |
| Thales | No strong view | But agree with Ericsson statement of unlikeable situation of multiple HO target in NTN |
| Intelsat | Probably not | Agree with Ericsson’s comments |
| Deutsche Telekom | See comment | We share Qualcomm’s view. Even if radio conditions are much more predictable in NTN compared to TN, there could be situations (change of beam characteristic on Earth, etc.), where a higher (but small) number of targets cells could be involved. We support Huawei’s proposal to capture assumptions as a minute or agreement (WA?). |
| Lockheed Martin | Probably Not | We agree with the justification for NTN’s deterministic / predictive characteristics |

Moderator’s summary:

13 companies provide comments.

9/13 companies think it is probably not the case that the source node can send multiple HO REQUEST messages to multiple target cells for the same UE during NG HO for NTN. One company has no strong view. And 3 companies think there could be situations that more than one target cells might be considered.

The moderator’s understanding is that there will be no stg3 impact regardless of whether one or more target cells are involved. So the moderator would suggest to capture the following information in the minutes in order to reflect RAN3’s understanding:

**RAN3 understands it is unlikely that a source gNB prepares more than one potential target cells for NG HO.**

The next open issue is whether to introduce the new time-related info which is assumed to be applied to both time-based NG HO and time-based Xn CHO. Some companies point out that the propagation delay may impact the time-based HO mechanism to work properly with the following observations,

NEC [4] observes:

**Observation 3: The apparent propagation of NTN HO will bring two problems:**

1. **If the UE starts to access Target gNB from T1+T2–Δdelay to T1+T2, the access procedure is expected to fail;**
2. **The Target gNB cannot receive the preamble from UE between T1 to T1+delay.**

Ericsson and Thales [7] observe and propose:

**Observation 1: Since the exact time window is configured in both the UE and the target gNB, if the handover is triggered near the end of the time window the UE may end up accessing the target cell after the target gNB has already released the prepared resources.**

**Observation 2: This depends on propagation delays due to the long distance between UE and gNB and may also vary with cell size according to deployment.**

**Proposal 1: RAN3 should further discuss and acknowledge this issue.**

So we’d like to check,

**Q6: Do you acknowledge the propagation delay issue for time-based HO? If the issue is acknowledged, what spec impact do you foresee?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | ACK or not | Comment |
| Ericsson | ACK | Our analysis is very similar to the one in [4]. The only slight difference is in the proposed solution.  Given that this is about the risk of a “late” access to the target cell, it seems more appropriate to address it by adding a margin to the time window instead of shifting the whole window as proposed in [4]. The target cell “keeps waiting” for the UE during this additional margin. In our proposal, the margin is decided by the target gNB, but it could also be suggested by the source gNB. If agreed, this should be adopted in both XnAP and NGAP. |
| CATT | No | We agree that the target cell “keeps waiting” for the UE during this additional margin which in Ericsson’s comment. But the time margin.i.e.T304 is configured by the target gNB, which is different from different target gNB. The candidate target gNB can decide locally when to release resources prepared for UE. |
| China Telecom | No | We agree that there may be a propagation delay between the time when UE access to target gNB and Handover Window info, the margin is decided by the target gNB. We do not understand why the source gNB recommendation is needed. It’s target gNB implementation without spec impact. |
| Nokia | No | Agree with CATT. It can be target gNB’s implementation. Target gNB can know the delay, so target gNB does not need to immediately release the reserved resource once the duration is expired. It can be same as normal HO that target gNB release the resource upon the reception of the HO Cancel from source gNB. Please also note, in case of NG-HO, the HO cancel is always needed since AMF need to be notified for the HO cancel. |
| Qualcomm | No | The source should decide the HO duration “T2” considering all the delays.  The target can set T304 based on HO duration T2. Hence we think it is not necessary to perform back and forth signaling to agree on T2 with some delay. |
| Samsung |  | The propagation delay issue exists, and we think such issue could be solved by target gNB’s implementation. |
| NEC | Yes | The time delay between UE and gNB is expected to be similar at the beginning and end of the time window, so it is reasonable to set them to one delay value, i.e., Δdelay.  The delay (Δdelay) between UE and gNB in NTN is much longer than that of NT. Therefore, as we proposed in Figure 2 in [4], the problems are:  1) The Target gNB cannot receive the preamble from UE between T1 to T1+Δdelay, which wastes resources.  2) If the UE starts to access Target gNB from T1+T2–Δdelay to T1+T2, the access procedure is expected to fail.  Based on the analysis above, a shift in the time window is more appropriate. |
| ZTE | No | Agree with CATT, up to target gNB’s implementation. |
| Huawei | Ack the problem | We acknowledge the issue, but we also think it can be solved by implementation method. |
| Deutsche Telekom | Ack | Problem can be solved by appropriate implementation. |

Moderator’s summary:

10 companies provide comments.

All companies acknowledge that the propagation delay aspect should be considered for time-based HO.

8/10 companies think the problem can be solved by gNB implementation. 2/10 companies think there could be NG/Xn impact.

Since there’s a clear majority view on supporting up to gNB implementation, the moderator would suggest to make a working assumption that,

**Proposal 6: WA: The propagation delay problem should be considered for time-based HO, which can be solved by gNB implementation.**

As a consequence, companies also provide proposals on whether to send LS to SA2.

Qualcomm [3] thinks it is necessary to send LS to SA2.

Ericsson together with other 6 companies [5] think it is unnecessary to send LS to SA2 for Q3 because the window related IEs are added in the transparent container with no impact to SA2 spec.

Nokia [9] thinks it is necessary to send LS to SA2 because TS 23.502 may be impacted by considering Q4.

So we’d like to ask,

**Q7: By keeping the answers to Q3-Q6 in mind, do you think it is necessary to send LS to SA2?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | ACK or not | Comment |
| Ericsson | No | What is on the table is only between the source and target gNBs. Even when considering Q4, if the stage 3 impact is kept within the containers, there is no impact to the core network. If such a solution is agreed, we can liaise SA2 afterwards, so that they can update their specifications if needed. |
| CATT | No | We agree with the analysis in [5]. As the additional information to be signaled is in the transparent container, no LS is needed at this time. |
| China Telecom | No | Agree with the analysis in [5]. |
| Nokia | Yes | The SA2 spec needs changes to capture Normal NG-HO signaling is used but air interface uses CHO RRCReconfiguration. In addition, at least following changes are needed:   1. How to handle the data forwarding in the spec, in the existing HO execution section, or a new section? 2. Source gNB behavior is different. It needs to be similar to Xn-CHO that Source gNB need to add the time-based trigger condition in the RRCReconfiguration sent to UE.   38.300 text:  6. The source gNB sends an RRCReconfiguration message to the UE, containing the configuration of CHO candidate cell(s) and CHO execution condition(s).  23.502 text:  2. S-RAN to UE: Handover Command (UE container).  UE container is a UE part of the Target to Source transparent container which is sent transparently from T-RAN via AMF to S-RAN and is provided to the UE by the S-RAN.  Source gNB need to add  the Time-base trigger condition, just like the Xn-CHO. |
| Qualcomm | Yes | Since we are introducing multiple enhancements to legacy NG HO, SA2 should be informed. Also as stated in Nokia paper [9] the call flow in TS 23.502 should be updated with the changes.  The HO call flow in TS 38.300 also needs to be updated. |
| Samsung | Tend to no | We share view with Ericsson. We can liaise SA2 afterwards when the whole solution is agreed. |
| NEC | No |  |
| ZTE |  | Depends on the progress of this meeting, i.e. whether the solution has any impact on SA2. |
| Huawei | Depends | It seems CN is not impacted if there exist only one target and no parallel transactions (pending to the understanding to Q5). |
| Deutsche Telekom | Not yet | We should have first a clear view/agreement on an appropriate solution, then we may trigger SA2, if needed. |

Moderator’s summary:

10 companies provide comments. And only 2 companies would like to send LS to SA2 this meeting, with the argument that there might be spec impact on TS 23.502; while several companies would like to liaise SA2 afterwards.

The moderator would suggest to liaise SA2 when there’s no open issues left for time-based NG HO, which could be captured in the minutes.

**Liaise SA2 when there’s no open issues left for time-based NG HO.**

**Brief summary: The moderator makes the following proposals in 3.2.**

**Proposal 3: Confirm to add the handover window start and duration IEs to the NGAP *Source NG-RAN Node to Target NG-RAN Node Transparent Container* IE. Endorse R3-231418 as the BL CR.**

**Proposal 4: Confirm to enhance the early data forwarding with data discarding for NG HO.**

**Proposal 5: Introduce a DL discarding related IE in Early Status Transfer Transparent Container IE. FFS on the IE name and other details.**

**Proposal 6: WA: The propagation delay problem should be considered for time-based HO, which can be solved by gNB implementation.**

**The moderator suggests to capture the following understanding in the minutes:**

**RAN3 understands it is unlikely that a source gNB prepares more than one potential target cells for NG HO.**

**Liaise SA2 when there’s no open issues left for time-based NG HO.**

## Others

Some companies propose to exchange Serving Cell Coverage Stop time as follows,

Qualcomm [3] proposes: **Proposal 6: Serving Cell Coverage Stop Time shall be exchanged via XN Setup procedure and Config Update procedure between the neighbouring gNBs for NTN cells to assist time-based CHO configuration. Endorse TP to TS 38.423.**

China Telecom [11] proposes: **Proposal 3: It is suggest to exchange NTN Cell Coverage Stop Time via Xn setup and Configuration update messages.**

And the moderator notice the following agreements we’ve achieved,

*The exchange of NTN Cell Coverage Stop Time between gNBs may be further discussed in future RAN3 meetings.*

*There is no need to exchange the cell coverage stop time in the signaling of time-based CHO parameters.*

So we’d like to ask,

**Q8: Is there any need to discuss the exchanging of serving cell coverage stop time over Xn given the agreement above?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Ericsson | No | This issue was already discussed several times, as early as the Rel-16 SI. Unless there is new evidence not discussed before, we see no need to revisit the current agreements. The serving cell stop time derives from the ephemeris, which is always configured in the RAN; the source and target will take that into account when setting the time parameters. |
| CATT | No | For Handover, normally, the source gNB can provide T1 and T2 to the target gNB, taking into account the stop time of the serving cell, and the start time of the target cell. It’s not necessary for a gNB to know the stop time of its neighbor cell. Even if it’s beneficial for handover, we could assume the necessary neighbor relations including the start/stop time of the cells are configured via OAM, according to the conclusion of Rel-17 NTN. |
| China Telecom | Yes | Exchange NTN cell coverage stop time can help the source gNB configure the handover for UE.  Yes, relying on OAM is always available, agree to follow the majority view. |
| Nokia | Yes | It is useful. For example, in case source gNB know the target NTN cell will stop service soon, the source gNB should not initiate a HO to target NTN cell. |
| Qualcomm | Yes | The Cell stop time of the neighboring cells is needed to choose the right target cell and T1 and T2 for CHO configuration.  Of course, every information exchanged over Xn can be obtained via OAM like the Served Cell Info and then the applicability of Xn becomes questionable.  However owing to the dynamicity of serving cell stop time and serving cell stop time being a necessary parameter for deciding the CHO configuration, our preference is to exchange this over Xn.  This information is also necessary to configure the location-based CHO for EMC case. |
| Samsung | No | If the cell coverage stop time can always be derived from the ephemeris. It is unnecessary to exchange such information over Xn interface. |
| NEC | No | Agree with Ericsson. |
| ZTE | No | Share the view with Ericsson. |
| Huawei | No | We share similar view as Ericsson. This is something known via OAM, what is the extra benefit to exchange over Xn? |
| Thales | No | Share the view with Ericsson and the Huawei’s argument of Xn overhead |
| Intelsat | No | Ideally there should be no coverage stop time or laps in the coverage area |
| Deutsche Telekom | No | Available info, if required, can be known via OAM. |

**Brief summary:**

12 companies provide comments.

9/12 companies see no need to introduce cell coverage stop time over Xn, and such information can be known via OAM. 3/12 companies support such enhancement over Xn.

Since both OAM approach and Xn approach could work, and there’s a clear majority to follow OAM approach, the moderator would suggest that,

**Proposal 7: No more discussion on the exchanging of serving cell coverage stop time over Xn, unless clear advantage(s) of Xn signaling over OAM configuration is newly identified.**

# References

|  |  |
| --- | --- |
| [1] [R3-231215](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231215.zip) | Remaining open issues on service continuity enhancement for NTN (Samsung) |
| [2] [R3-231255](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231255.zip) | Cell ID over Xn for NTN (Qualcomm Incorporated, CATT, Nokia, Nokia Shanghai Bell, NEC) |
| [3] [R3-231258](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231258.zip) | Discussion on NTN Service Continuity Enhancements (Qualcomm Incorporated) |
| [4] [R3-231387](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231387.zip) | Discussion on Mobility and Service Continuity Enhancements for NTN (NEC) |
| [5] [R3-231417](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231417.zip) | NGAP Support for Time-Based HO in NTN (Ericsson, Thales, Intelsat, Lockheed Martin, Hughes Network Systems, CATT, ESA) |
| [6] [R3-231418](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231418.zip) | Time-Based HO for NTN - NGAP Impacts (Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, CATT, ESA) |
| [7] [R3-231419](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231419.zip) | Time Margin for CHO in NR NTN (Ericsson, Thales) |
| [8] [R3-231420](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231420.zip) | Time Margin for CHO in NR NTN - XnAP Impact (Ericsson LM) |
| [9] [R3-231476](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231476.zip) | Discussion on the time-based trigger condition in NR NTN (Nokia, Nokia Shanghai Bell) |
| [10] [R3-231477](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231477.zip) | Support time-based trigger condition in NG-HO (Nokia, Nokia Shanghai Bell) |
| [11] [R3-231509](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231509.zip) | Remaining issues on NTN mobility enhancement (China Telecommunication) |
| [12] [R3-231669](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231669.zip) | Discussion Mobility and Service Continuity Enhancements for NTN (CATT) |
| [13] [R3-231691](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231691.zip) | Further discussion on mobility issue for NR NTN (ZTE) |
| [14] [R3-231697](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231697.zip) | (TP for NTN BL CR 38.300) Cell ID for non-UE associated Xn procedures (ZTE) |
| [15] [R3-231756](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231756.zip) | Further discussion on cell ID usage and TAC (Huawei) |
| [16] [R3-231757](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231757.zip) | Further discussion on NG HO (Huawei) |